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# Performance and Potential of Man-Made Fibres*

Speaking before The Fashion Group, I cannot help but pay due credit and honor to the people who work in one of the great fields in clothing. There are really basically only two: Fashion, and the performance of the fashion...I think too frequently we people who are in the technical end of the business do not fully appreciate what the fashion people do for us, because you can have the most serviceable item in the world and it would not be worth a darn unless it were fashion-right. By the same token, people in the technical end of the business feel that sometimes you fashion people do not fully appreciate the need for service qualities in the items that are put out. There should be, and usually is, a happy balance between service qualities and fashion, in any successful promotion of clothing.

The Committee felt that the fundamental properties of the man-made fibers, and the influences which make or break fabrics on the market, could well merit some attention. But before we get into a discussion of the actual man-made fibres with which we are concerned, I would like to touch upon the production figures of fibres as a whole. It is not news to any of you that cotton is our most widely used fibre. There are, or for 1951 were, consumed some 4,908 million lobs. of cotton, constituting 71% of the total. Wool had a consumption rate of 489 million lbs., constituting 7.1% of the total fibre consumption. Silk had 6 million lbs. in production, constituting 1/10 of 1% of the total fibres on the market. Rayon and acetate 1,276 million lbs., or 18.5%. Other man-made fibres, 210 million lbs., or 3.1% of total production, and when one realizes that out of this 210 million lbs., 150 million of these were in nylon, that leaves but 9/10 of 1% for the newer man-made fibres other than rayon, acetate, nylon.

Those were the 1951 consumption figures. All of the producers of these newer man-made fibres are planning expanded production. Only early this spring, the Orlon production was at the rate of 30 million lbs. per year. Next year, other producers are planning to come in with man-made fibres in approximately that same ratio, 30 million lbs. per year. So 1952's figures for man-made fibres other than rayon and acetate will be higher. It is with that thought that we are looking forward to the future, based on the performance of these fibres, limited in quantity as they have been to date.

Now what are these fibres? Rayon, acetate, nylon, acrilan, Dynel, Dacron, Orlon, Saran, X-51, American Cyannamid's yet unnamed fibre, and Vicara. These are only fibres, or yarns, and their use in any given fabric or construction is by no means an assurance of quality. We all should realize that many factors of prime importance enter into the performance of a fabric, and fibre content is but one of the important factors.

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*Talk given by Dr. W. E. Coughlin, Director, Textile Laboratory, Good Housekeeping Institute, October 21, 1952.

The other factors are: FIBRE-TYPE. Naturally, the performance of the finished fabric is going to vary with the use of a hydrophobic fibre versus a hydrophilic one (one that absorbs water and one that doesn't), and one that is thermoplastic and one that is not. FIBRE FORM. Almost all of these man-made fibres, with the exception of Vicara, occur in both filament and spun or staple form. Filament yarns are made from endless filaments, many miles in length, thereby producing a very smooth yarn. Staple fibres being in the order of magniture of inches, or fractions of inches in length, produce a fuzzy type of yarn, and fabrics made from them are usually referred to as spun fabrics. Then, there are such variables as the denier per filament. You can have coarse fiber, either in filament form or spun form, thus again altering, from the standpoint of fibre constitution alone, the performance of the fabric in question, YARN CONSTRUCTION. Here we could have a loose twist, or a tight twist. We could have plied yarns or slubbed yarns, and they all have their influence on the ultimate performance of the fabrics. FABRIC CONSTRUCTION enters into the picture. We can have open or tightly-woven fabrics, or twills, for example. The fabrics could be knitted or woven or napped, or they could appear in many other different forms--all important factors in the performance and appearance and fashion-rightness of the fabric. FINISHING. Is the material in question preshrunk? Are the dyes fast to various fading agencies? If it is a spun fabric, has it been sheared or is it of the very fuzzy type? Is it napped or is it embossed? All of these finishing factors, whether they be special finishes for water repellency or crease resistance and the like, enter into the performance of the fabric.

Let us consider some of the basic properties of man-made fibres. Fortunately, they are not all so dissimilar that we have to remember a separate list of properties for each of the new fibres. Many of them have very close similarity in their properties, and as a result we can organize our thinking concerning these fundamental properties. With the exception of rayon and Vicara, all of the man-made fibres are thermoplastic. Thermoplasticity means that they can be molded by heat. You could get permanent pleats as the result of the presence of thermoplastic yarns, depending upon the amount of the fibre present in the fabric. As a result, most of t hose thermoplastic yarns contribute durable crease resistance, as well as durable or permanent types of pleating, to the fabric in which they are used, depending upon the percentage of the thermoplastic fibre used. With all of these fibres, if they are used in any great percentage in the fabric, we observe the same rules that w e have followed for years in the handling of acetate as far as finishing is concerned, ironing and the like. It is desirable with all of these fibres to iron on the reverse side of the fabric, and to prevent glazing as much as possible. Only Dynel, and possibly Saran, have such low melting points that fabrics made entirely of these fibres should not be ironed with the conventional irons that are on the market today. It has been my observation that manufacturers using these fibres blend them in such a way that the lower softening point of the yarn is compensated for by a non-thermoplastic fibre, used along with it, or when constituting 100% of the fabric, the fabric is used in garments

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that require no ironing. Many of these fabrics made from thermoplastic yarns may be heat-set, where their dimensional stability is increased considerably. The classic example of that is nylon, and nylon fabrics must be heat-set, whereas that is not a necessity, but oftentimes a great help, with the other thermoplastic types of fabrics.

Another common property that all of these thermoplastic yarns possess is a low moisture content. They absorb but very little moisture under any set of conditions. They are quick-drying, and that may be somewhat of a handicap. In some instances, you wish to have absorbency in a fabric, as in intimate attire. On this matter of the moisture absorption of fabrics made of thermoplastic yarns; they vary in absorbency, depending upon whether they are made of filament yarns, or spun yarns. When we have thermoplastic fabrics made of filament yarns, there is but little total surface compared to the same amount of yarn used in spun yarn fabrics. There we have protruding fibres which present a much greater surface to the moisture that is available to be absorbed, and, because of physical consitution alone, they will hold much more moisture than the filament yarn fabric of the very same fibre content. I do not mean to say that a spun yarn fabric made of these hydrophobic fibres will by any means match the absorbency of wool or cotton, rayon or Vicara, where the absorbency is very great compared even to the spun yarn fabrics made of the thermoplastic types of yarns.

Many statements have been made about the non-staining qualities of these new fibres, and, theoretically, that is correct. Sometimes we are too prone, from a given flashy demonstration, to conclude too much about the properties of any given fabric. The public sometimes thinks that if we use some of these new man-made fibres of the thermoplastic type that stains are going to be no problem any more, and the dry cleaner is going to go out of business. Low-moisture content or low-moisture absorbability in any fabric means that water-soluable stains, such as fruit juices and water-borne stains, will not be absorbed very readily, but by no means does it mean that these fabrics won't stain quite thoroughly when stained with non-water-borne substances. Work which we have done on shirts made of some of the new man-made fibres indicates the fact that at the collars and cuffs where something more than plain water has stained the fabric, especially body oils and greases, the stains are much more difficult to remove. This is even more true if the stain has remained in the fabric for a week or more, and the stain removal is much more difficult than the corresponding stain removal on the hydrophilic type of fibre, such as cotton, rayon, wool, Vicara.

Another important property that all of these thermoplastic fibres have in common is their ability to take permanent pleating if sufficient heat and pressure are applied...I know that fibre producers cannot police the industry to make sure all these operations are carried out right, but we ought to let the people who are using our fabrics know that they are not that miraculous that you can mishandle them and still get good results. Everyone has to do his part to make the operation work correctly. Permanent pleating can also be carried out with blends,

even though as much as 50% of the blending fibre is not of a thermoplastic type: 50-50 wool and Dacron, or Orlon or Dynel, acetate, any of the thermoplastic fibres can be blended, but there is a limit to the proportion of the thermoplastic fibre that must be present to get permanent pleating...

Almost all of these thermoplastic fibres have good resistance to wrinkling, and that is not unusual, because wrinkling is due as much to absorption of moisture as to anything else. A damp fibre will crease much more readily, and since all these fibres have low-moisture absorption, we naturally can expect wrinkle-resistance to follow...You can get first-class wrinkling in many of these fabrics, depending upon the construction of the fabric, and the construction of the yarn as well, but in general, comparing comparable constructions, they have very good wrinkle resistance. The dimensional stability of fabrics made from these fibres is very good, and that ties up with the fact that they are not affected to any great extent by water as far as their tensile strength and general physical properties are concerned.

Another question that is often discussed is the warmth or the coolness of fabrics. It would be nice to say that all fabrics made from these fibres are either warm or cool. It was well proven during the past war, and brought to the attention of many people, that the warmth of a given fabric is dependent primarily upon the number of dead air spaces between the fibres. Hence, if you get any type of fibre in a fabric that will create dead air spaces and give you a fluffy, fleecy surface, you will have produced a warm fabric because dead air is a good insulating medium. On the other hand, you can take the same fibres that have produced a really warm fabric when in fleece form, or in blankets where many of the newer thermoplastic fibres are being used, and use them in filament form and have something not too good as an insulator. The fabric can be cool depending upon how porously the fabric is woven. Thermoplastic, or hydrophobic fabrics, even when in fairly open construction, are considered by many people to be quite uncomfortable in summertime, due to the fact that they do not absorb moisture, and as a result, when in close contact with the body they will allow perspiration to flow directly on the body without absorbing the moisture and dissipating it through evaporation.

There are other important properties: that the thermoplastic fibres are mildew resistant, and resistant to moths. Most of these fibres have good risistance to sunlight deterioration, and the one which probably is best known for that property is Orlon, the acrylic fibre. Acrilan, which is basically or chemically almost identical with Orlon, although varying according to the secrets of the manufacturer, will have similar properties as far as resistance to sunlight deterioration is concerned. Fabrics made from these yarns also can be washed or dry-cleaned, depending upon the construction of the fabric and the construction of the finished garment. They have good abrasion resistance, as measured in the laboratory abrasion machines.

What are some of the shortcomings of these new fibres and fabrics? Many people have complained about the static effects that occur in fabrics made entirely of hydrophobic yarns. That can sometimes be embarassing, especially on cold, dry winter days, as you women undoubtedly know. Static properties make possible the ready absorption of dust, as compared to the non-static fabrics. A good deal has been said about the fact that many of these new blended fabrics: wool and Orlon, or Dacron or Dynel, are unsatisfactory. I have heard responsible people say on the basis of but little information, that you can't blend a type of fibre that will absorb a lot of moisture with one that won't because you get pilling. We at Good Housekeeping Institute went out of our way to purchase a number of different garments to determine that very thing, and found out, as might be expected, that the construction of the fabric has much more to do with the matter of pilling than does the fibre content, or the blend in question. Not so long ago, I returned a very fine Shetland-type wool sport coat to a manufacturer. The pilling was so bad that it was unwearable. I am not saying this to be critical of wool, but rather to show that wool can pill, depending upon the construction.

The manufacturers of pressing equipment for the handling of fabrics made of the newer blends have been giving thought to production problems, both in cutting-up plants, and in dry-cleaning plants. I want to bring up a troublesome problem that has bothered some clothing manufacturers working with fabrics of thermoplastic yarns: Considerable trouble has been experienced in pressing suits made of these spun fabrics, especially in dark shades, and the people in the pressing equipment business have recognized this problem, and have been working on it for nearly two years. They realize that two main factors influence the production of shine: the uneven distribution of the steam as it comes through the press head...A new plate, which is ingeniously designed to go inside of the press head, not only dissipates the steam over the entire head of the press, but also cools down the steam to such a degree that the fabric is not overheated, thus making it much less susceptible to glazing. A new type of grid surface has also been made which is vastly superior to any ever used before from the standpoint of preventing shine...

What do these fabrics have to offer to the fashion field? The public has been the deciding factor over many years as to whether fashions sell or not. Price is a concern also in the merchandising of fabrics made from these fibres. They are generally higher-priced than the bread-and-butter fibres, i.e., rayon, acetate. We can look for lower prices, I presume, if the newer fibres that are on the market follow the same price trend that their predecessors have followed. Great emphasis has been placed on the service qualities of these new fibres by the producers. Not very often do we see claims made that the fabric in question is better-looking than silk or wool, or better feeling than wool, but rather that certain service qualities have been contributed to the fabric: Permanent pleating, lower cost of upkeep, etc. These blends permit the production of a great variety of fabrics. Washable fleeces that were unheard of in the past are now with us, and

no one can deny that their washability is a very important factor...We can no longer go on fiber content alone as the criterion of quality. As these new fabrics are brought out made from the different blends of fibres, it behooves the manufacturers of the fabrics and the garments to have really worthwhile test data available before they are placed on the market.

We have got to mention not only the fibre content, but also the performance qualities of the fabrics and garments in question. Otherwise, the sales person and the public will be 'at sea' trying to make sense out of names that are so new...A good job of selling will require that we do more labeling, and more efficient labeling, as distinguished from fibre identification alone: Informative labeling that will tell how the fabric or garment in question can be taken care of, and why the blend in question is used--one fibre for beauty, another for absorbency, and another for crease-resistance, if 3 or 4 are used.

In summary, I think we have to think not so much of miracle fibres, but of fabric production and what the industry will do with these new fibres. The progress made with man-made fibres in the comparatively short time they have been on the market is truly phenomenal. But let's not forget that many other factors are involved besides fibre content alone.